

The Point Source Properties of Nearby Spiral Galaxies

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Spirals Survey

- 11 spiral galaxies
 - nearby ($< 15 \text{ Mpc}$)
 - spanning Hubble sequence (S0 through Sd), hence a wide range of SFR
 - low inclination ($i < 30^\circ$)
 - low nH ($< 10^{21} \text{ cm}^{-2}$)
 - at least 2 observations per galaxy to study variability
 - completeness limit of $\sim 10^{36} \text{ erg/s}$
- NGC 278 Sb
- M74 (NGC 628) Sc
- NGC 1291 S0/a
- NGC 2681 S0/a
- NGC 3184 Scd
- NGC 4314 SaB
- M94 (NGC 4736) Sab
- M51 (NGC 5194/95) Sbc/interacting
- M83 (NGC 5236) Sc(B)
- M101 (NGC 5457) Scd
- IC 5332 Sd

Science Topics

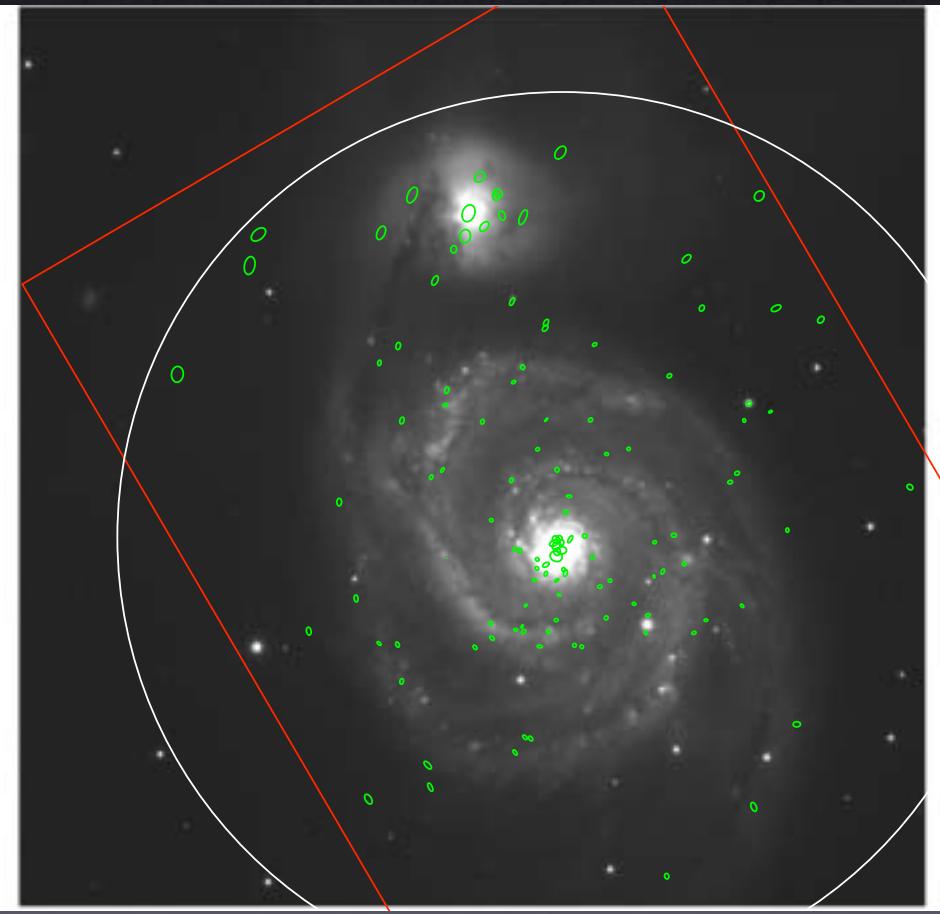
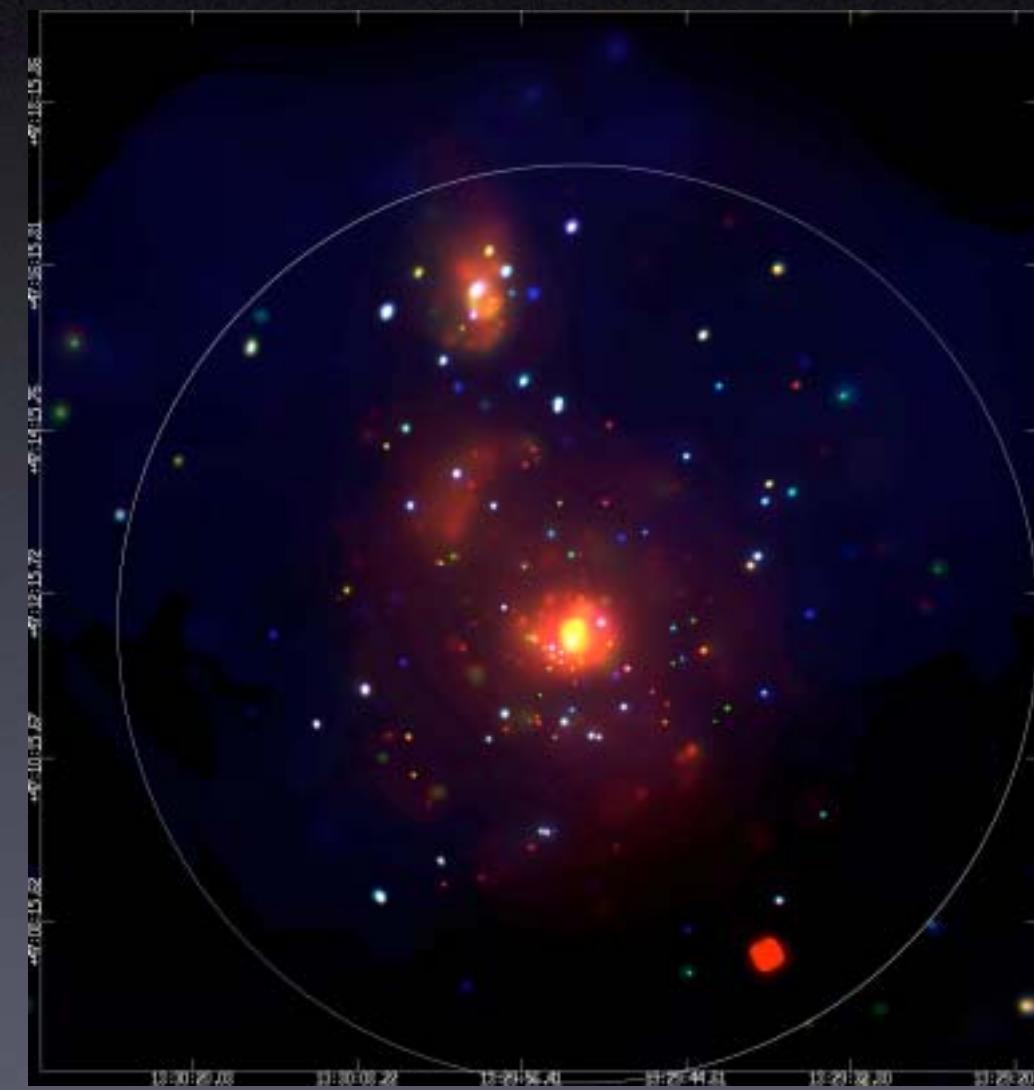
- Discrete Source Luminosity Functions
 - Source spectra, colors, and variability
 - source environments
 - multi-wavelength counterparts
-

Star Formation

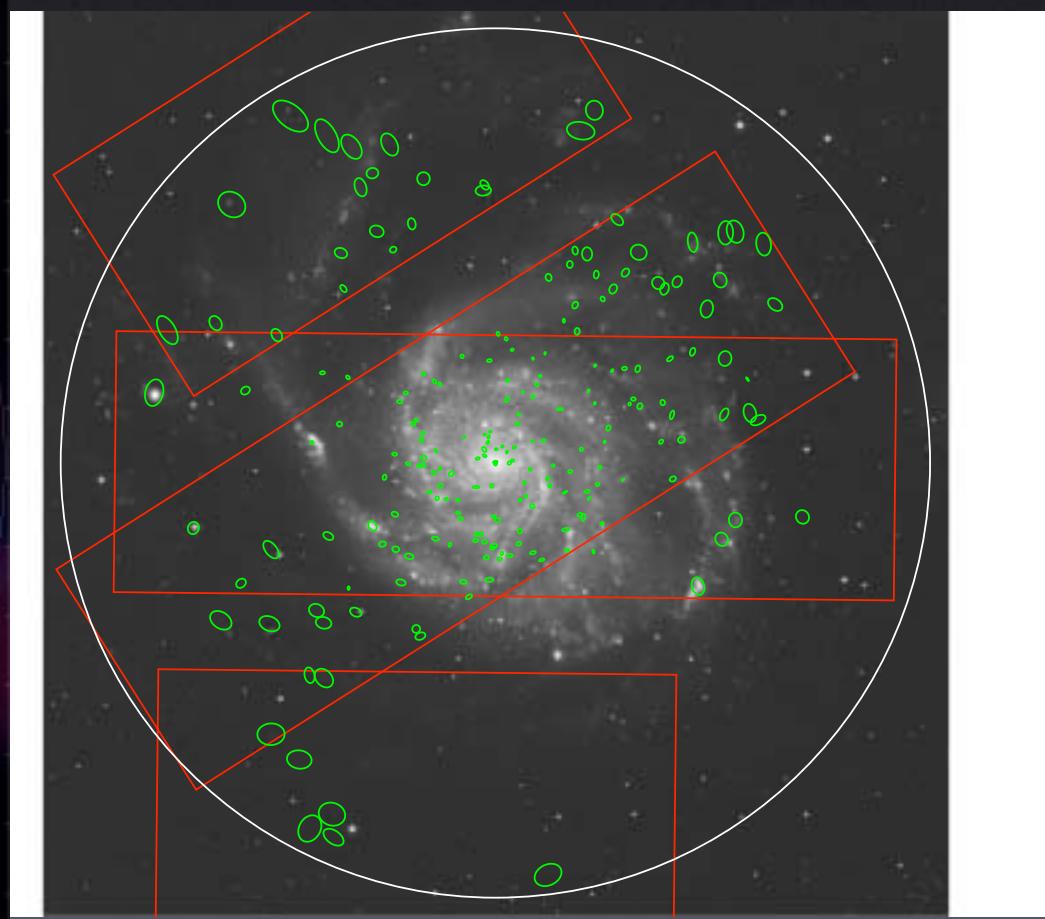
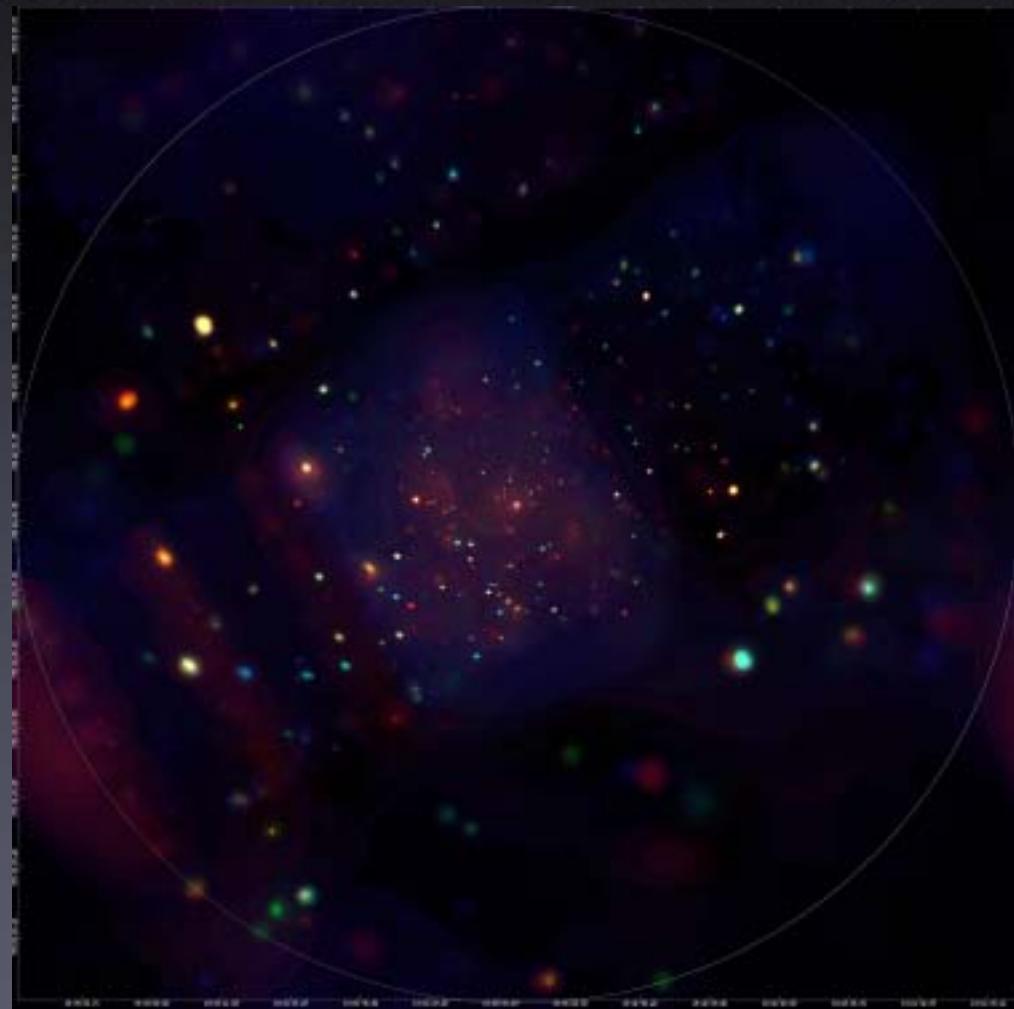
Survey Statistics

- 869.6 ksec of Chandra data (good-time)
- 919 point sources within D_{25} ellipses (plus hundreds of serendipitous sources)
 - counts (soft, med, hard, total)
 - hardness ratios
 - fluxes and luminosities
 - variability info
 - spectral fits (if enough counts)
 - identified optical/radio counterparts
 - initial source classifications
- ~ 19 ultra-luminous X-ray sources ($L_X > 10^{39}$ erg/s)
- other unique sources

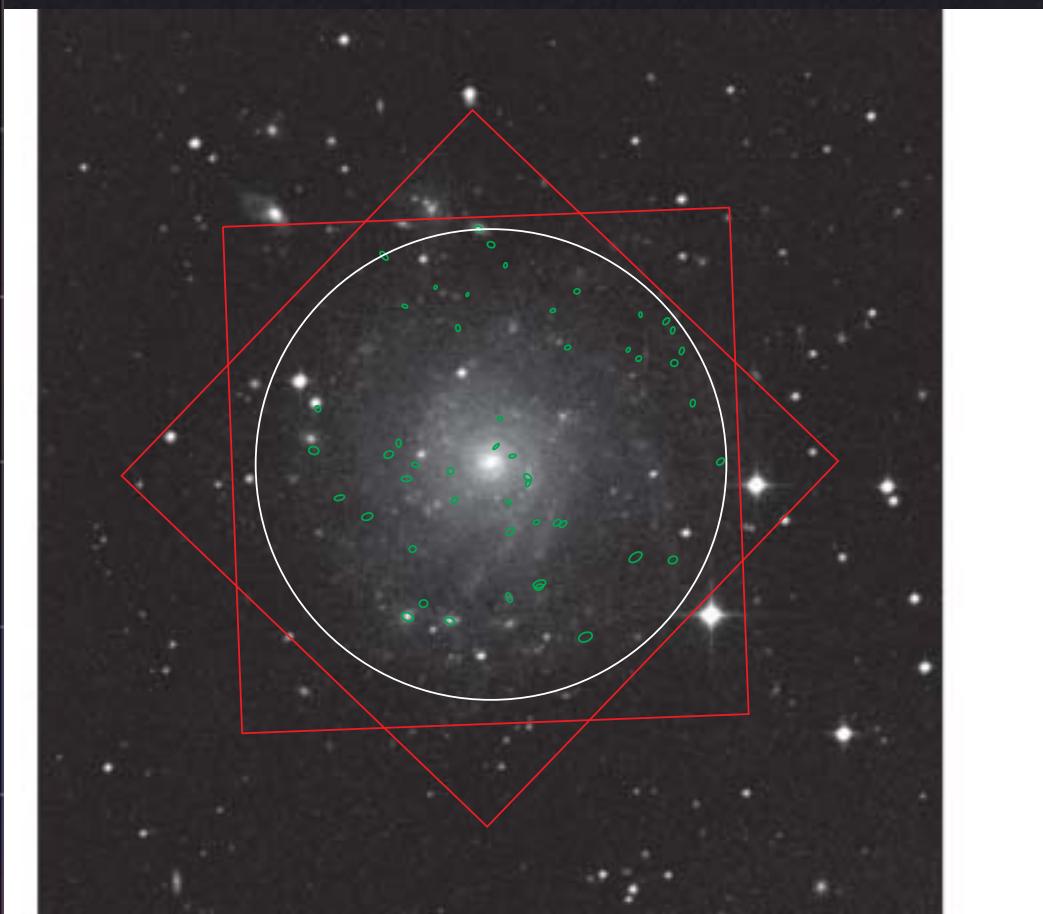
M51



M101



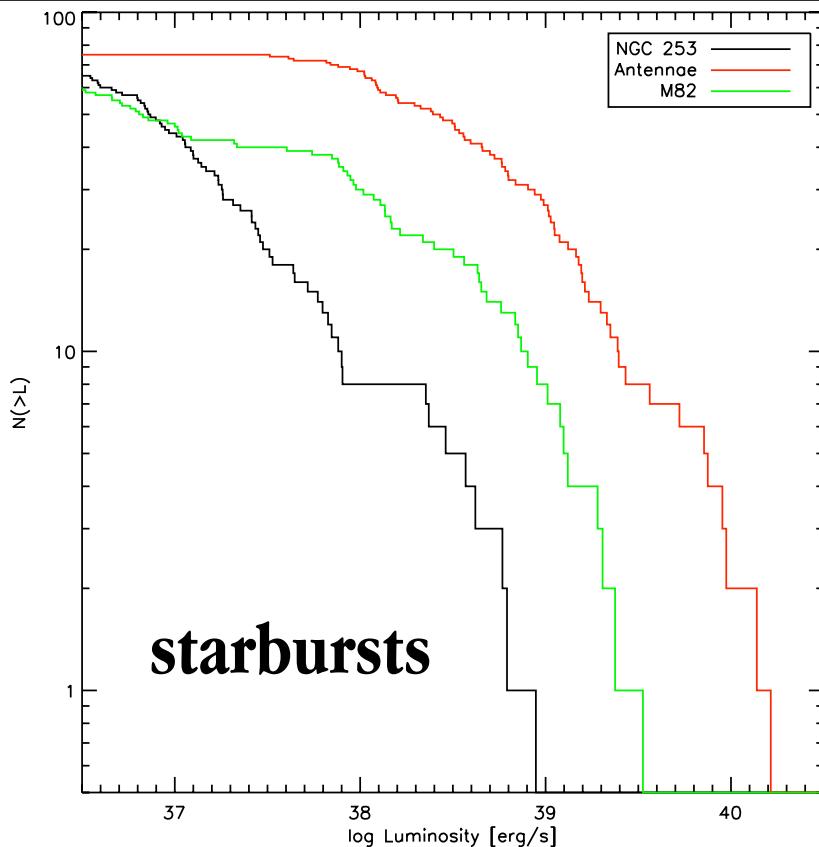
IC 5332



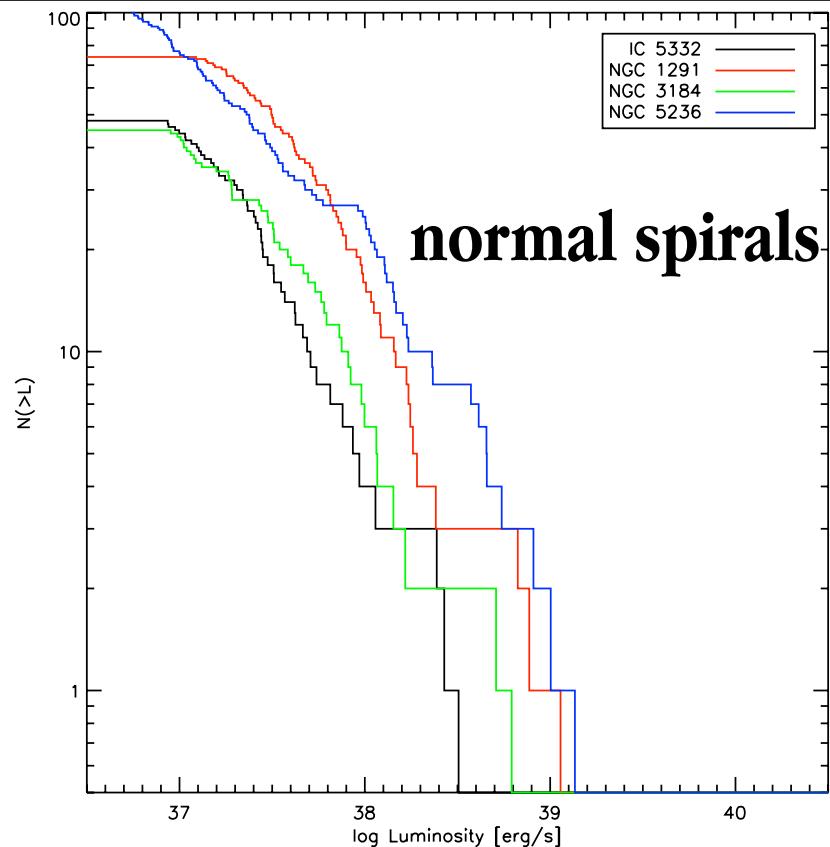
Discrete source luminosity functions

(see Kilgard et al., 2002 ApJ, 573, 138)

LF slopes of starburst galaxies are flatter than those of normal spirals

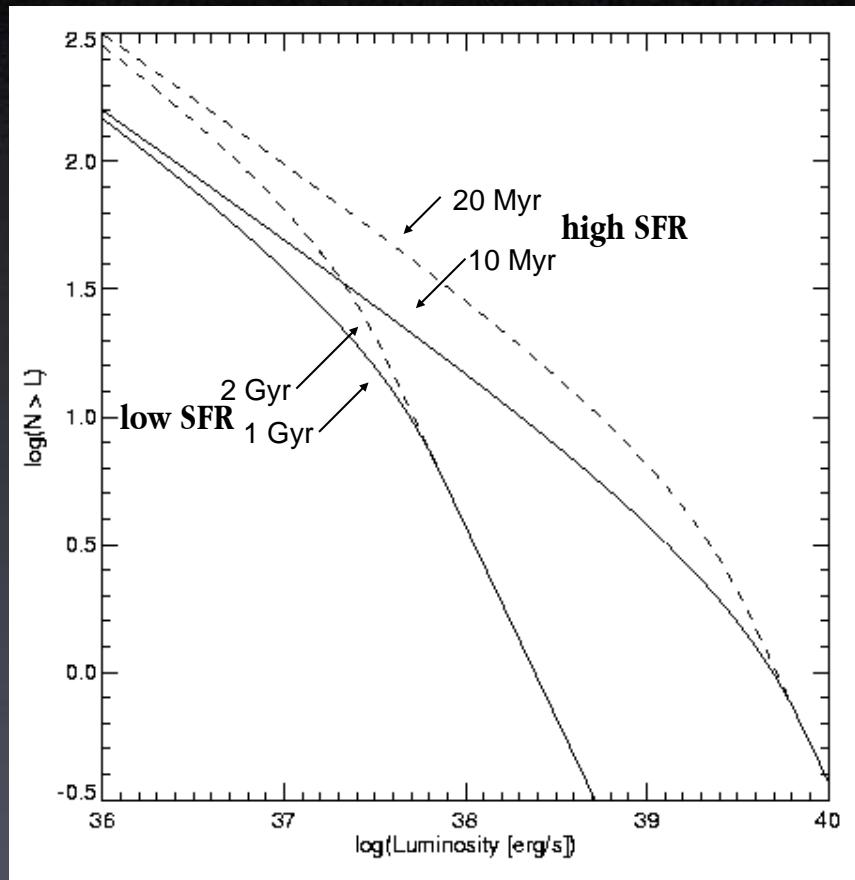


starbursts



normal spirals

Simulating star formation



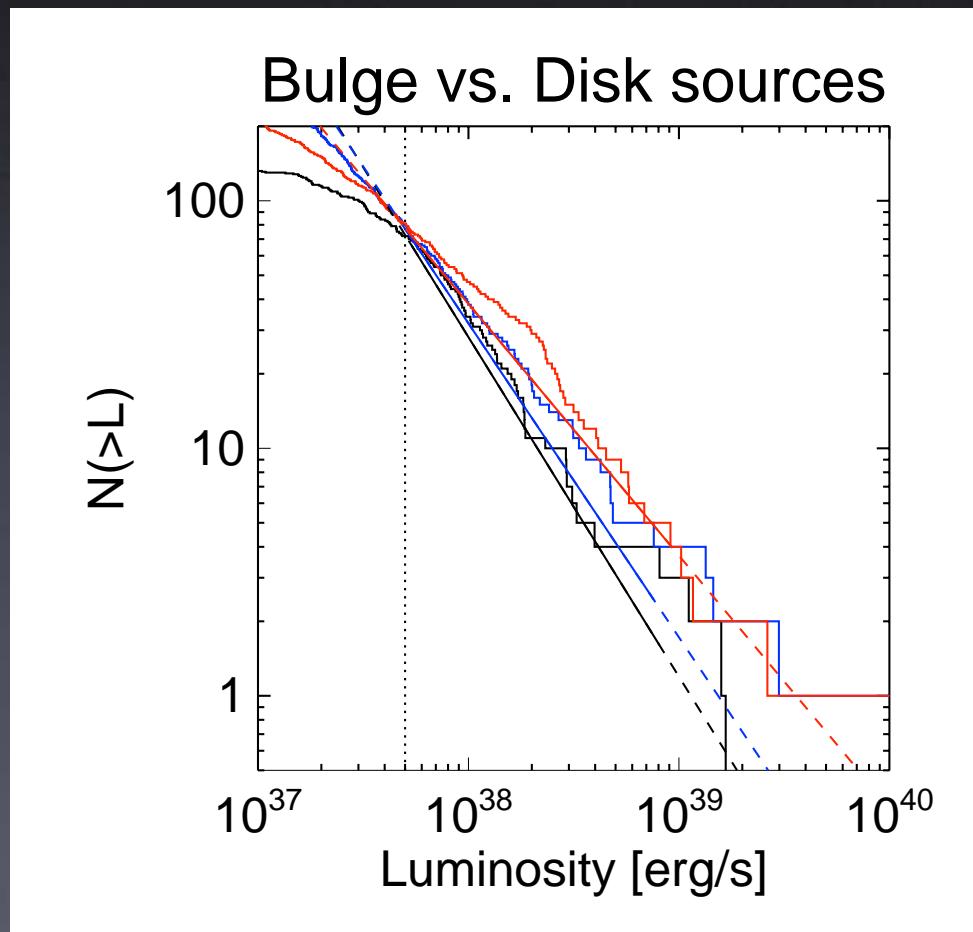
See Poster 12-18,
K. Wu et al.

Model cumulative luminosity functions

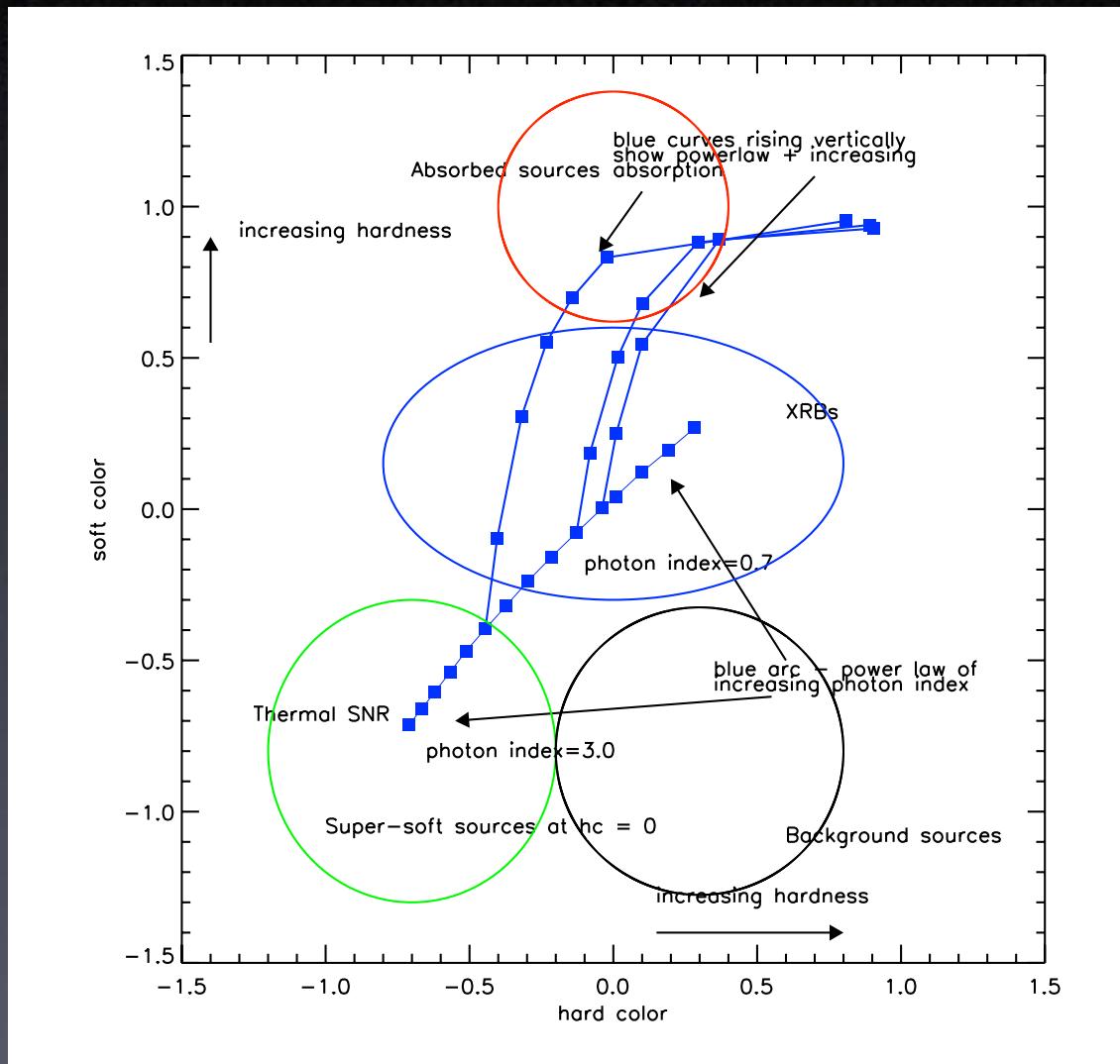
- Young stellar populations have flatter LFs above 2×10^{37} erg/s
- High energy cutoff $> 10^{39}$ erg/s

Survey Luminosity Functions

galaxies with high SFR have slightly flatter LF slopes than do both disk- and bulge-dominated galaxies

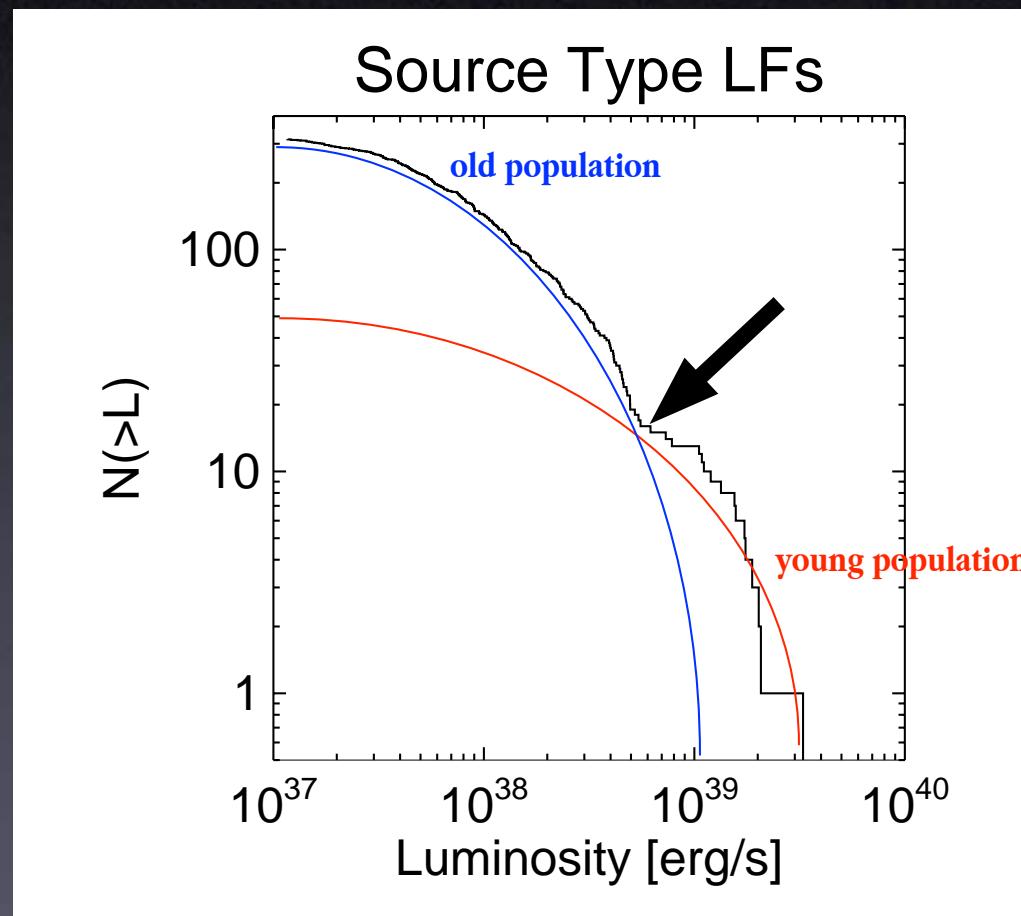


Colors

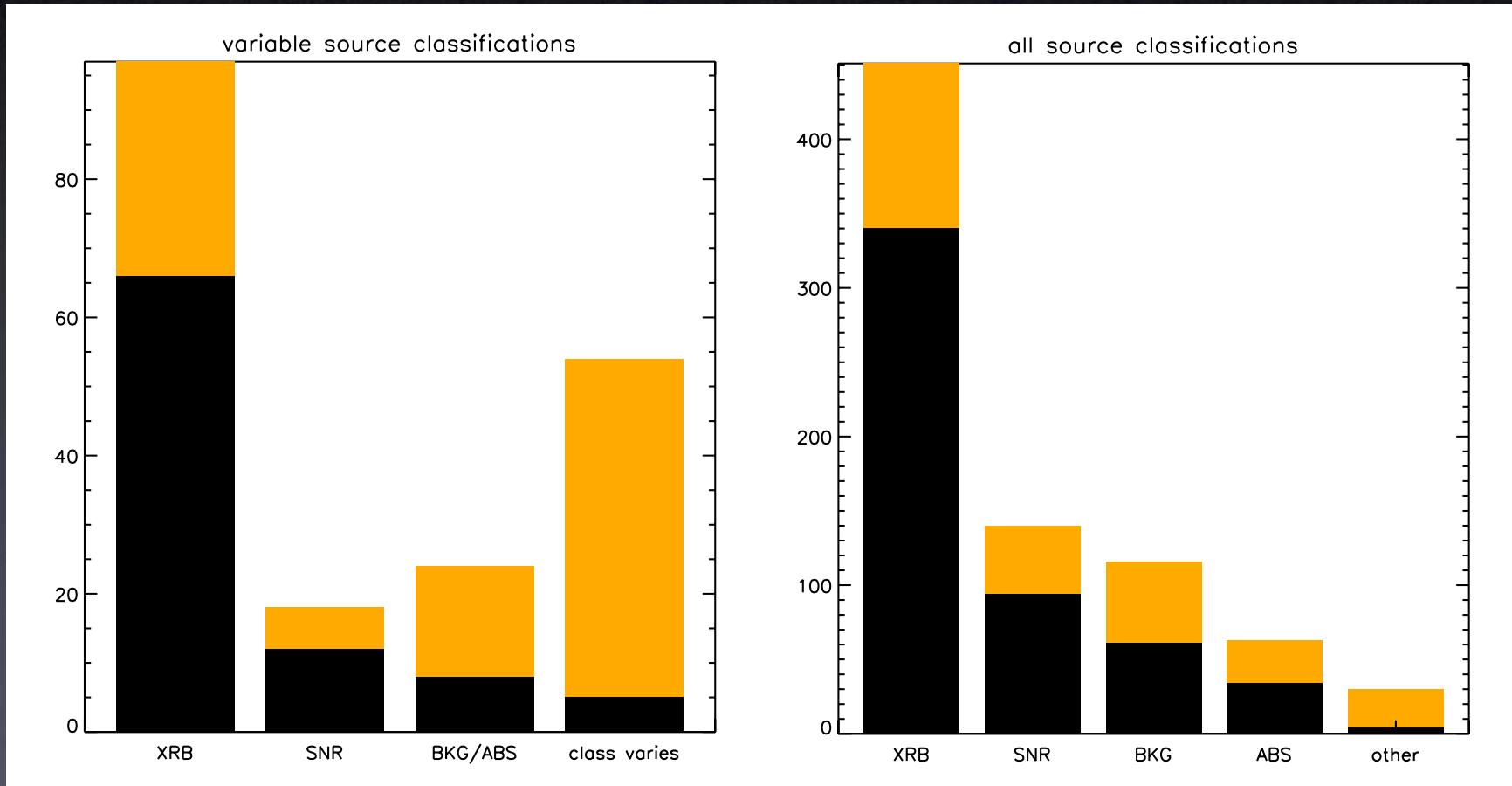


Prestwich et al.
2003 ApJ, accepted

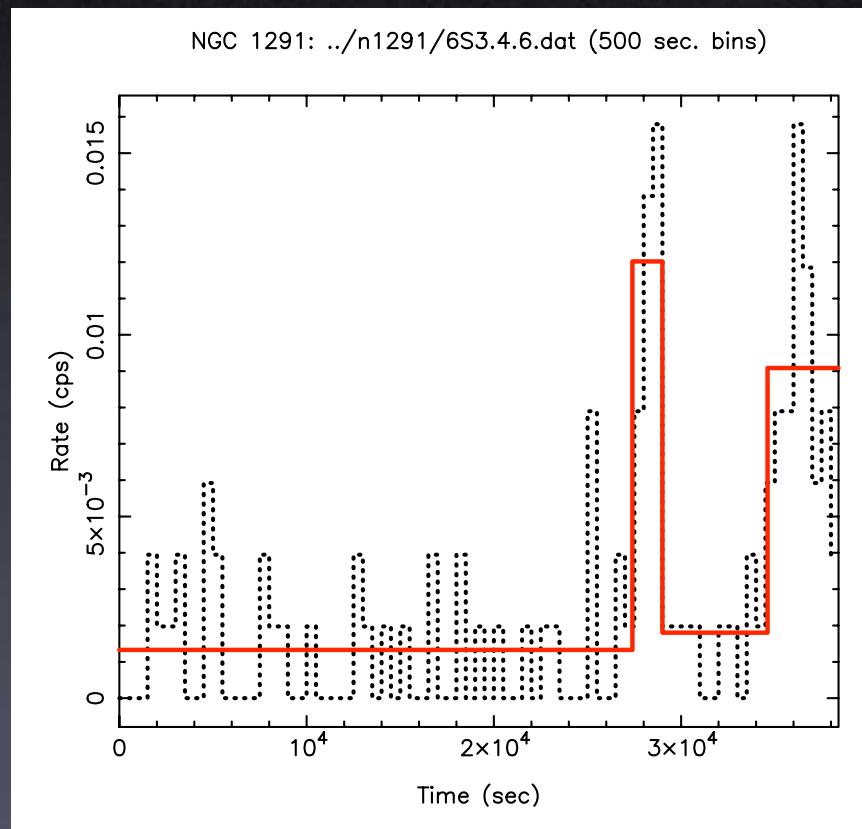
Luminosity functions by color



long-term variability

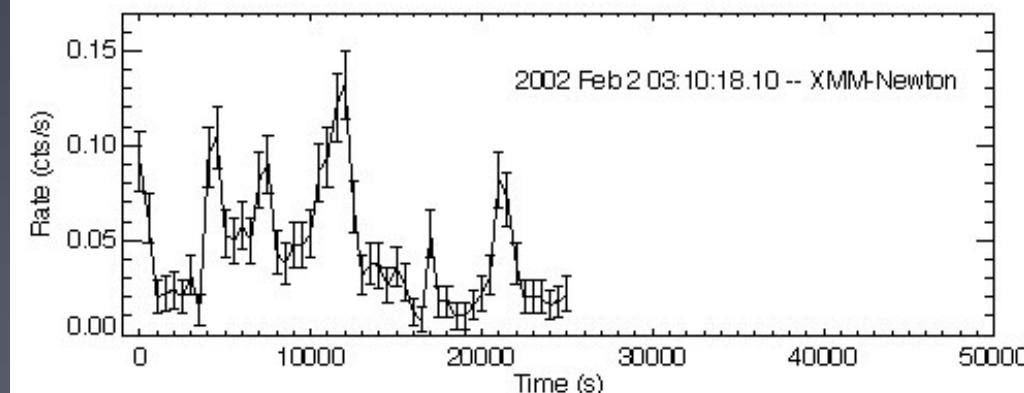
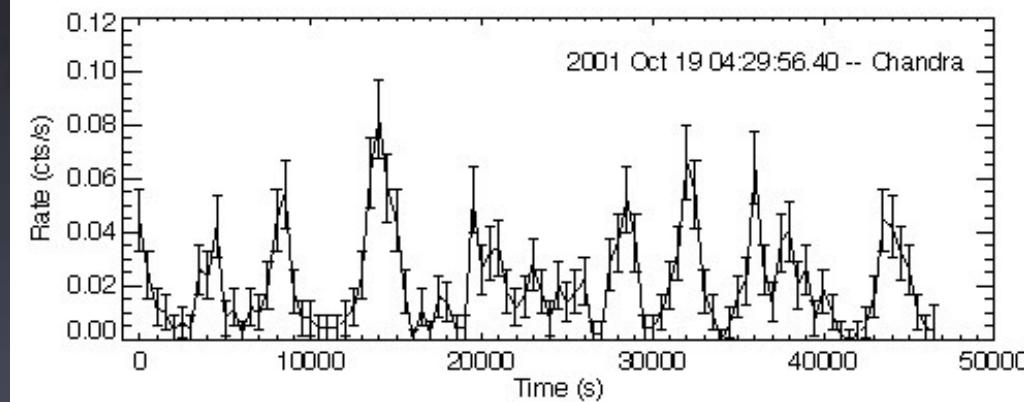
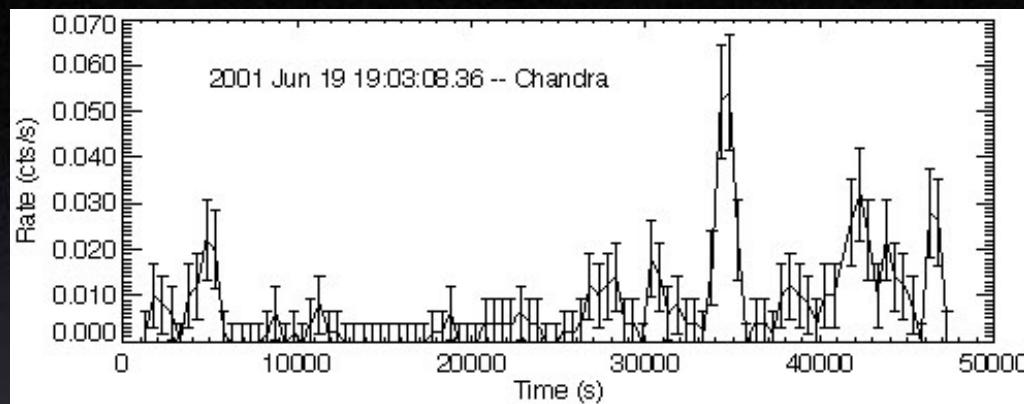


short-term variability



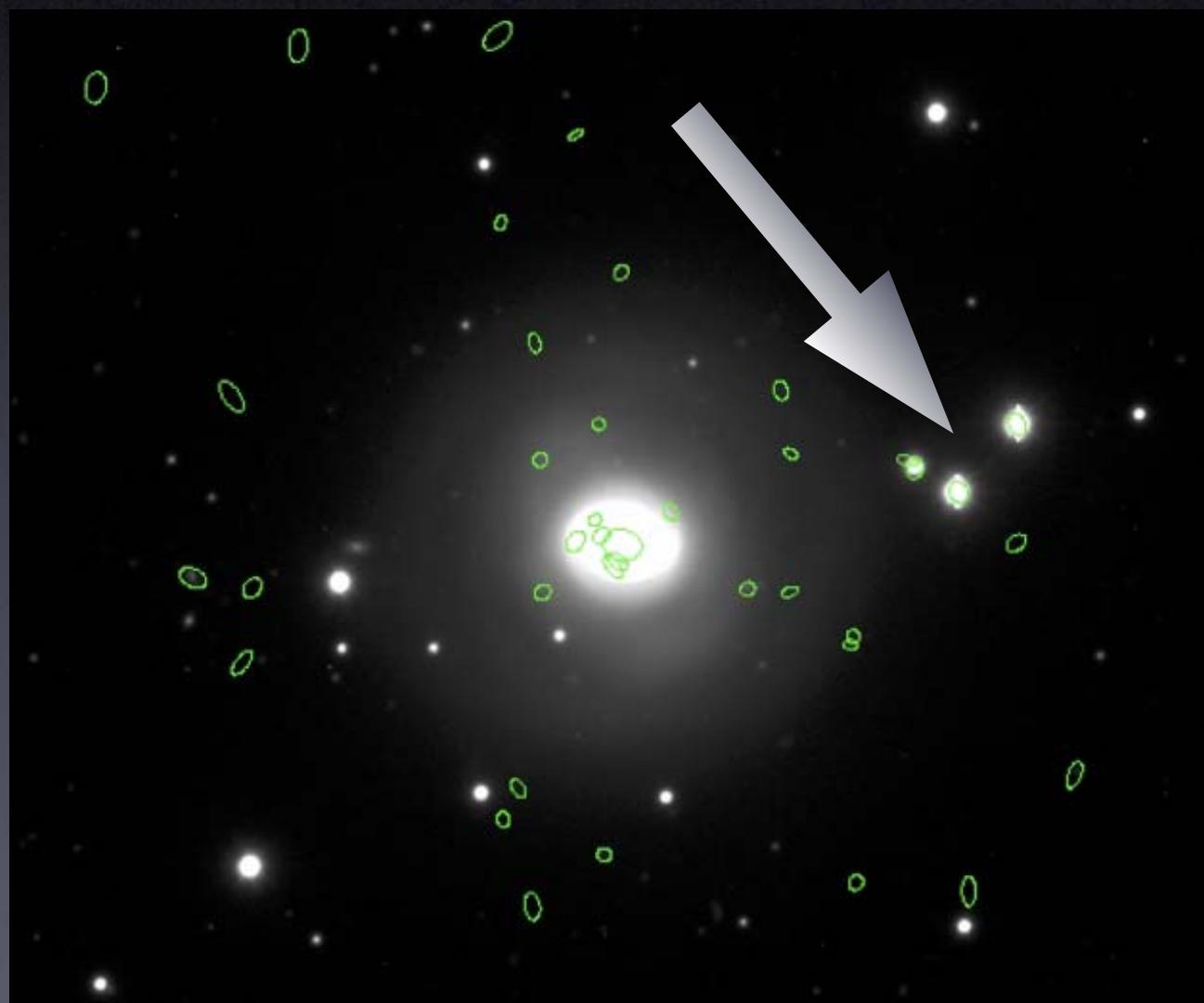
CXOU J031736.8-410901

lightcurves of the ULX M74 X-1

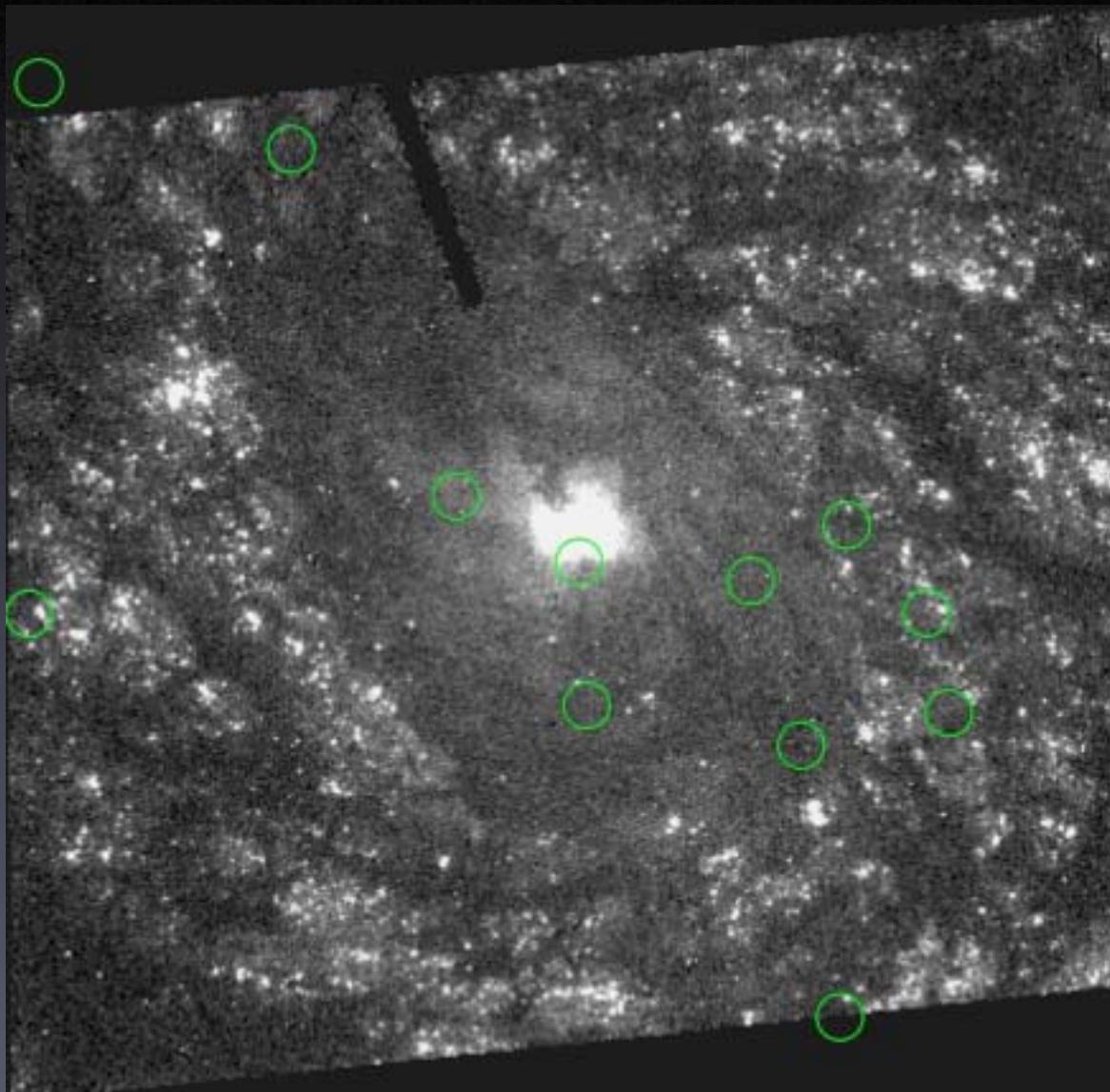


M. Krauss et al.
2003 ApJ, pending

optical counterparts

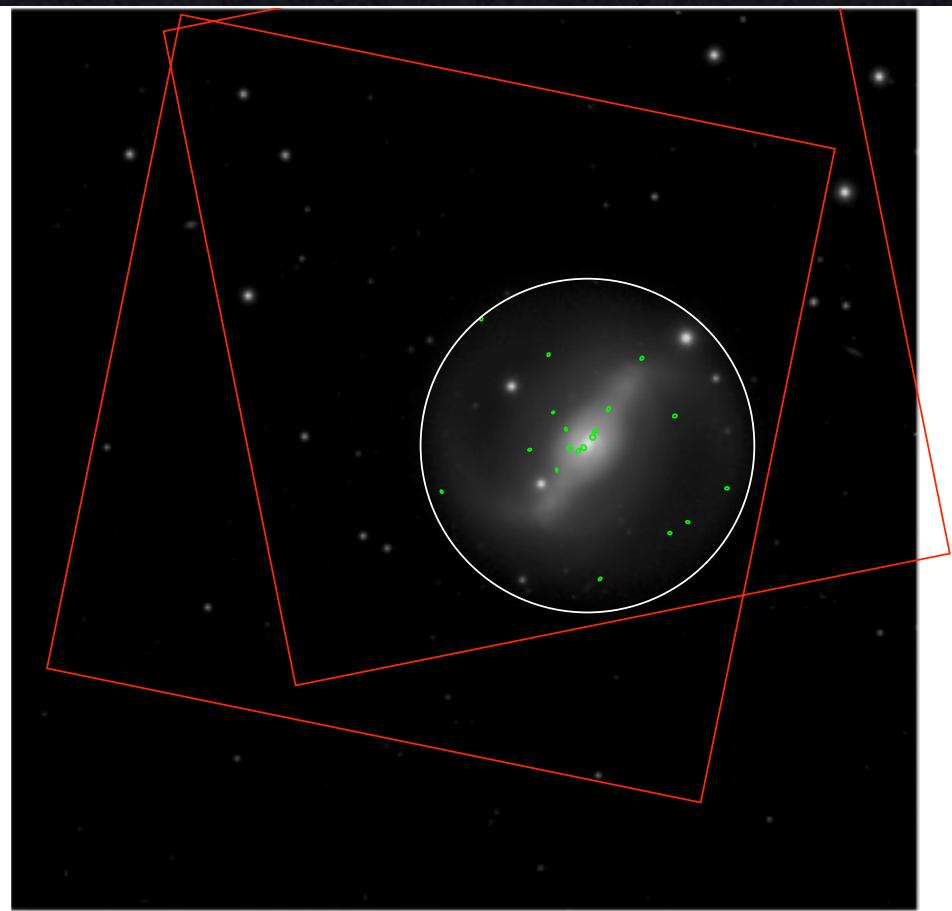
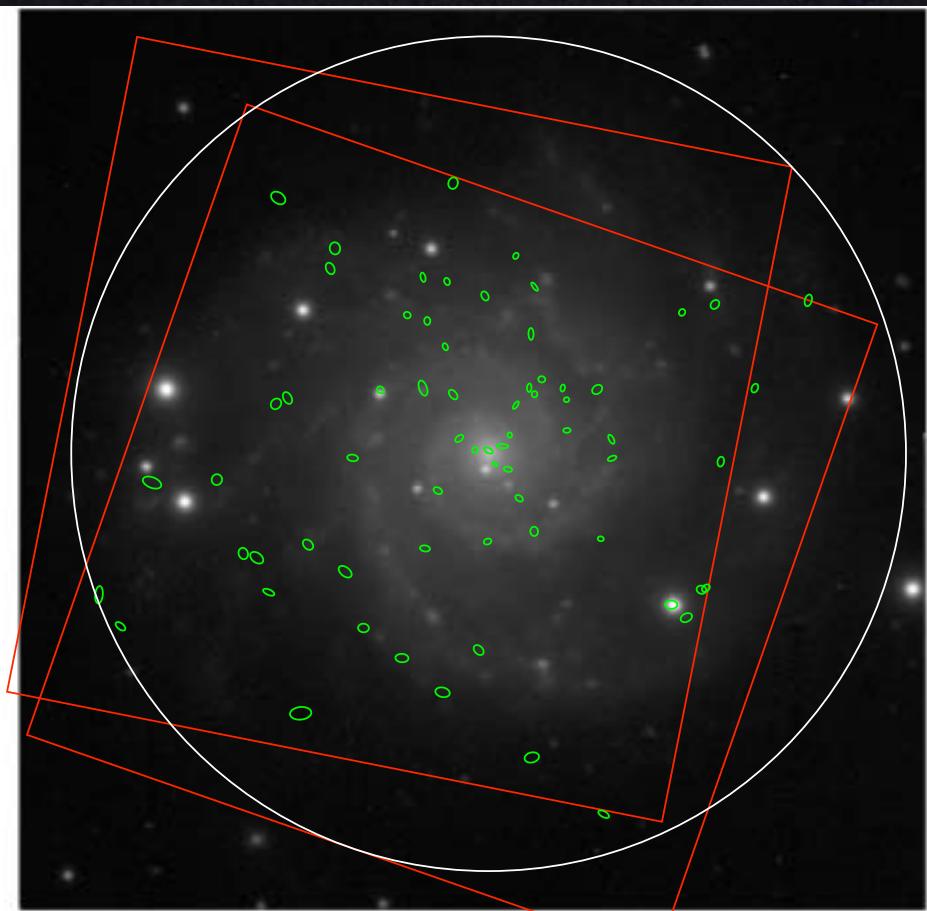


optical counterparts



???

Environments



Conclusions

- X-ray LFs of individual galaxies are correlated with SFR of those galaxies
- Point source classification from colors and variability:
 - may allow insights into SF history of the local universe
 - uncovers unique sources that allow us to perform “Galactic” astronomy beyond the Local Group
- Work is continuing...